414 Rec'd PCT/PTO 01 DEC 2000 PCT

12-04

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TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371

U.S. APPLICATION NO. (If known. see 37 CFR 1.5) 09/701854

INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED
PCT/EP99/03893	June 4, 1999	June 4, 1998

TITLE OF INVENTION

METHOD AND SYSTEM FOR CLEANING SEMICONDUCTOR ELEMENTS

APPLICANT(S) FOR DO/EO/US

GOTTSCHALK, Christiane; SCHWECKENDIEK, Jürgen; BRAMMER, Ulrich

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ **This is a FIRST submission of items concerning a filing under 35 U.S.C. 371.**
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☒ **This express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).**
4. ☒ **A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.**
5. ☒ **A copy of the International Application as filed (35 U.S.C. 371(c)(2))**
   a. ☐ is transmitted herewith (required only if not transmitted by the International Bureau).
   b. ☒ **has been transmitted by the International Bureau.**
6. ☒ **A Verified Translation of the International Application into English (35 U.S.C. 371(c)(2)).(14 pgs)**
7. ☒ **Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(C)(3))**
   a. ☐ are transmitted herewith (required only if not transmitted by the International Bureau).
   b. ☐ have been transmitted by the International Bureau.
   c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
   d. ☒ **have not been made and will not be made.**
8. ☐ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371 (c)(3)).
9. ☐ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. ☐ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(C)(5)).

Items 11. to 16. below concern document(s) or information included:

11. ☐ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. ☒ **A FIRST Preliminary Amendment (3 pgs)**
    ☐ A SECOND OR SUBSEQUENT preliminary amendment.
14. ☐ A substitute specification.
15. ☐ A change of power of attorney and/or address letter.
16. ☒ **Other items or information:**

Copy of PCT Notice Form PCT/IB/308 (2 pgs)
Copy of International Publication No. WO99/62649 (16 pgs)
Copy of PCT Demand (PCT/RO/101) (4 pgs)
Copy of Search Report (PCT/ISA/210) (5 pgs)
Copy of Chapter II Demand (PCT/IPEA/401) (4 pgs)
Copy of International Preliminary Examination Report (PCT/IPEA/409) (5 pgs)

09/701854

17. ☒ The following fees are submitted:

CALCULATIONS	PTO USE ONLY
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BASIC NATIONAL FEE (37 CFR 1.492 (a)(1) – (5)):

Neither international preliminary examination fee (37 CFR 1,482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO $1000.00

International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO $860.00

International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO $710.00

International preliminary examination fee paid to USPTO (37 CFR 1.482) but all claims did not satisfy provisions of PCT Article 33(1)-(4) $690.00

International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(1)-(4) $100.00

ENTER APPROPRIATE BASIC FEE AMOUNT =				$860.00	
Surcharge of **$130.00** for furnishing the oath or declaration of later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492(e)).				$ 0	
CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE		
Total claims	24 – 20 =	4	X **$18.00**	$ 72.00	
Independent claims	2 – 3 =	0	X $80.00	$ 0.00	
MULTIPLE DEPENDENT CLAIM(S) (if applicable)			+ **$270.00**	$ 0	
TOTAL OF ABOVE CALCULATIONS =				$ 932.00	
Reduction of ½ for filing by small entity, if applicable. A Small Entity Statement must also be filed (Note 37 CFR 1.9, 1.27, 1.28)				$ 0.00	
SUBTOTAL =				$ 932.00	
Processing fee of **$130.00** for furnishing the English translation later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492(f)). +				$ 0.00	
TOTAL NATIONAL FEE =				$ 932.00	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). **$40.00** per property +				$ 0.00	
TOTAL FEES ENCLOSED =				$ 932.00	
				Amount to be: refunded	$
				charged	$

a. ☒ **A check in the amount of $932.00 to cover the above fees is enclosed.**

b. ☐ Please charge my Deposit Account No. _____ in the amount of $_____ to cover the above fees. A duplicate copy of this sheet is enclosed.

c. ☒ **The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 20-0531.**

NOTE: When an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

Patent Administrator
Testa, Hurwitz & Thibeault, LLP
125 High Street
High Street Tower
Boston, MA 02110

SIGNATURE

Jamie H. Rose
NAME

45,054
REGISTRATION NUMBER

December 1, 2000
DATE

rose473/1.1115322-1

PATENT
Attorney Docket No. ASX-056

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICANT:	Gottschalk et al.		
SERIAL NO.:	Not yet assigned	GROUP NO.:	Not yet assigned
FILING DATE:	herewith	EXAMINER:	Not yet assigned
TITLE:	METHOD AND SYSTEM FOR CLEANING SEMICONDUCTOR ELEMENTS		

Assistant Commissioner for Patents
Washington, D.C. 20231

PRELIMINARY AMENDMENT

Prior to examination, please enter this Preliminary Amendment and consider the following remarks.

In the Specification

On page 2, line 1, after "pp", please insert -- t --.

On page 3, line 14, please delete "decomposition rate was able to be almost", and there insert --half-life was able to be more than --.

In the Claims:

In claim 3, line 1, please delete "or 2".

In claim 4, line 1, please delete "to 3".

In claim 5, line 1, please delete "to 4".

In claim 9, line 1, please delete "or 8".

In claim 10, line 1, please delete "to 9".

In claim 11, line 1, please delete "to 10".

Please add new claims 13-24, as follows:

--13. The method of claim 2 further characterized in that the cleaning is carried out in the tank, air being extensively or entirely excluded.

14. The method of claim 2 further characterized in that CO_2 is directed into the highly pure oxygen flow which is supplied to the ozone generator in order to achieve a stable concentration behaviour of the ozone generator.

15. The method of claim 3 further characterized in that CO_2 is directed into the highly pure oxygen flow which is supplied to the ozone generator in order to achieve a stable concentration behaviour of the ozone generator.

16. The method of claim 3 further characterized in that the ozone is supplied to the contactor in counterflow to the DI water.

17. The method of claim 16 further characterized in that CO_2 is directed into the highly pure oxygen flow which is supplied to the ozone generator in order to achieve a stable concentration behaviour of the ozone generator.

18. The method of claim 4 further characterized in that CO_2 is directed into the highly pure oxygen flow which is supplied to the ozone generator in order to achieve a stable concentration behaviour of the ozone generator.

19. The device according to claim 8 further characterized in that the container is configured as an overflow tank with a collection device for the spent DI water.

20. The device according to claim 8 further characterized in that a part of the spent DI water is directed into the circulation via a filter and cleaning device.

21. The device according to claim 8 further characterized in that the container is sealed from the environment.

22. The device according to claim 9 further characterized in that a part of the spent DI water is directed into the circulation via a filter and cleaning device.

23. The device according to claim 22 further characterized in that the container is sealed from the environment.

24. The device according to claim 10 further characterized in that the container is sealed from the environment.--

REMARKS

Applicants hereby amend the specification and claims 3-5 and 9-11, and add new claims 13-24. All amendments are fully supported by the application as originally-filed. The specification amendments are supported, for example by the specification at page 3, lines 3-13 and Figure 2. The claim amendments and new claims serve to eliminate the multiple dependency of the originally filed claims. No new matter has been added. Claims 1-24 are pending in the application.

Applicants respectfully request examination and allowance of all pending claims (i.e., claims 1-24) in due course. If the Examiner believes that a telephone conversation would advance the prosecution of this application, the Examiner is cordially invited to telephone the undersigned agent of record.

Respectfully submitted,

Date: December 1, 2000

Jamie H. Rose
Reg. No. 45,054
Agent for the Applicants

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Fax No.: (617) 248-7100

Method and system for cleaning semiconductor elements

The invention relates to a method and a system for cleaning semiconductor elements, such as wafers or the like according to the preamble of the method claim or the device claim.

It is known that semiconductor slices are treated with liquid chemicals, in particular also ozonised, deionised (called DI in the following) water. The most varied systems for this purpose are known which comprise recirculation systems and so-called "single-pass" (one-way) systems. All of the systems have a container in which the semiconductor slices are received and through which the cleaning liquid flows, which comprises ozonised DI water and possibly other chemicals. The container can thereby be configured as an overflow tank, as a through-flow tank, as a rotary tank or the like and the supply of liquid can also be effected in the most varied manner, for example by being sprayed into the container via nozzles or being introduced via pipelines as a stream of liquid. In the case of recirculation methods, at least a part of the spent cleaning liquid is returned to circulation via filter and cleaning units, i.e. mixed with fresh ozonised DI water. The container is connected to a device for generating ozonised DI water via pipelines, in which device ozone, which is fed from an ozone generator, is dissolved in highly pure DI water.

In the case of such systems according to the state of the art, the ozone concentration in the ozonised DI water fluctuated and the inventors have set themselves the object of producing a method and a system for cleaning semiconductor elements by means of which a constantly high ozone concentration is achieved for the ozonised, deionised water which is used for cleaning.

This object is achieved according to the invention by the characterising features of the main claim and of the independent claim.

It is typical for the DI water provision in the semiconductor industry (also referred to as UPW = ultrapure water) to have extremely low conducting

capacity (18 Mohm/cm), a low metal ion content (< 1 pp/metal) and a small proportion of organic material (TOC (total organic carbon): < 1 ppb), the DI water being neutral, i.e. the pH value is normally around 7.

It has been shown that the desired high ozone concentrations were not able to be produced for all of the highly pure waters used, for example, ozone concentrations of just 20 ppm were achieved, on the one hand, whereas 50 to 120 ppm were achieved on the other hand. In the case of low ozone concentrations it has been established furthermore that they depend only very little on the liquid flow volume while normally the ozone concentration increases when the flow volume becomes smaller. For example, in the case of flow volumes of 2 l/min, an ozone concentration of up to 150 ppm was achieved, with a flow volume of 10 l/min up to 70 ppm and with 20 l/min up to 40 ppm, while, in the other case with the same volumes, ozone concentrations respectively of 15 ppm, 10.5 ppm and below 20 ppm (not illustrated) were achieved.

Such a phenomenon is illustrated in Fig. 1, the characteristic lines show the ozone concentration relative to the through-flow of the DI water, "row 1" showing measured values for the expected ozone concentration and "row 2" showing measured values for an unexpected low ozone concentration.

It was hence shown that a significant ozone decomposition occurred although, because of using DI water of high purity, metal ions or metal oxides which catalyse the ozone decomposition, were not expected. The TOC value, which can be used as a measure for those substances which can reduce or consume the ozone by reaction with ozone, is small so that an appreciable loss was not expected.

The invention is therefore based on the surprising knowledge that, although it is not to be expected on the basis of expert knowledge, the decomposition rate of the ozone is increased in various DI waters. In Fig. 2, characteristic lines are indicated for the half-lives of ozonised liquids from the literature relative to the pH value. According to these data from the literature, the calculated half-life of

the ozone decomposition is of the magnitude of approximately 1000 seconds, at a water temperature of 200 °C and a pH value of 7.

In the case of another DI water, which fulfilled the same criteria as the DI water corresponding to the literature data, namely it contained few metal ions and low pressure and also a pH value between 6.8 and 5, the decomposition rate was high, the half-life was determined to be approximately 150 seconds, as is illustrated in Fig. 2 by the measured value "Condition 1".

According to the invention, CO_2 was added to the ozone/oxygen mixture generated by the ozone generator. By adding CO_2 to the DI water, the decomposition rate was able to be reduced without substantially affecting the pH value and in fact there were achieved a half-life of approximately 750 seconds and an ozone concentration as is otherwise normal. This is shown in Fig. 2 by the measured value "Condition 2", DI water with CO_2 supplement, it being able to be detected that the decomposition rate was able to be almost tripled relative to the measured value "Condition 1".

Figure 3 shows the ozone concentration at the outlet of the system for a through-flow of 10.75 l/min relative to the dosage of the DI water with CO_2, the DI water without dosage showing the decomposition rate corresponding to "Condition 2" according to Fig. 2.

It can be detected from Fig. 3 that, with a dosage of less than 1% CO_2, the system according to the invention could already deliver a threefold ozone concentration in comparison with the DI water which has no CO_2 added. It is supposed that this behaviour can possibly be explained by the suppression of the radical decomposition chain of ozone, CO_2 as "Scavenger" slowing down the radical decomposition of ozone. It is supposed that traces of peroxides are present in the DI water which can possibly occur during UV treatment of DI water for the purpose of disinfection, when oxygen has not been completely removed during processing of the DI water. At the same time, a lowering of the pH value can be expected.

In total, the cleaning effect of semiconductor elements by means of ozonised, deionised ultrapure water can be stabilised by the method according to the invention and the system according to the invention since, because of the supply of CO_2, the ozone concentration of the system according to the invention can be kept uniformly high even when using different DI waters.

An embodiment of the system according to the invention, given by way of example, is illustrated in the drawing and the method according to the invention and the device according to the invention are explained in more detail by consulting the drawing in the subsequent description, which shows:

Fig. 1 a diagram of the dissolved ozone concentration relative to the through-flow of the DI water with two different types of DI waters,

Fig. 2 a diagram of the half-lives of ozone in corresponding liquids relative to the pH value from the literature and also for the two different DI waters corresponding to Fig. 1,

Fig. 3 a diagram of ozone concentration relative to the dosage of CO_2 for a specific through-flow of the DI water, and

Fig. 4 a schematic representation of an embodiment of the system according to the invention.

The system illustrated in Fig. 4 has a device 1 for generating highly pure ozonised DI water and a device 2 for cleaning wafers or semiconductor elements, as is known from prior art. The device for generating ozonised DI water has an ozone generator 3 which operates according to the principle of silent electrical discharge. The ozone generator 3 is connected to a source of highly pure oxygen, not illustrated, and to a source of highly pure CO_2, not illustrated, the CO_2 being supplied to the inlet of the ozone generator 3 via a choke 4 and to the output of the ozone generator via a valve 5. The ozone generator 3 has a through-flow of cool water, which is represented by the arrows 6. A contactor 7 is connected to the output pipe of the ozone generator

3 and DI water is fed to said contactor for the semiconductor industry (UPW). The contactor has aqueous film-forming particles in its container which offer large exchange surfaces between water and supplied ozone. The contactor 7 is pressurised.

An ozone annihilator 8 is connected to the contactor 7. Furthermore, there is provided an ozone sensor 9 which measures the ozone concentration. A control unit 10 controls the method parameters of the device 1.

The device 1 is connected to the cleaning device 2 for semiconductor elements via pipelines 11. Said cleaning device has an overflow tank 12 with an inner tank 13 and a collection tank 14. The semiconductor slices are stacked in the inner tank 13 and the pipeline 11 is connected to the inner tank 13. The overflow tank 14, which is sealed off from the surrounding air in the embodiment, has a discharge pipe 15 for spent DI water. If necessary, a part of the spent water can be returned via the recirculation pipe 17, drawn in broken lines, in which the filter and cleaning units 16 are provided.

The cleaning device 2 is represented only schematically here; of course supplementary devices, such as tanks for various chemicals, which can be added to the ozonised DI water, can be provided.

In the system illustrated in Fig. 4, the DI water (UPW), which has a low metal ion content, a small TOC proportion, a low conducting capacity and a pH value of around 7, is fed into the contactor 7, which is preferably operated at increased pressure in order to increase the solubility of ozone in DI water which is applied for example at room temperature. In the illustrated system, ozone is supplied by counterflow. In another embodiment, the ozone can also be supplied by co-current flow, although these arrangements have the disadvantage that the ozone concentration which, when leaving the contact device, remains in equilibrium with the liquid, is reduced by the quantity of dissolved ozone and consequently a lower concentration is achieved in the liquid.

The ozone is generated by the ozone generator 3 which operates according to the principle of silent electrical discharge. In the schematic representation, the illustration of devices, which are used for pressure and flow volume control, are dispensed with. Safety and control valves and filters, which are required, are also not indicated as they are not the subject of the invention.

Highly pure CO_2 is added to the ozone/oxygen mixture, which is generated by the ozone generator 3, via the valve 5 and in fact in concentrations greater than 99.95%. By dosing with CO_2, the radical decomposition of ozone is slowed down and the pH value of the DI water is lowered.

The $O_2/O_3/CO_2$ mixture is dissolved in the DI water in the contactor 7 and excess ozone in the gas phase is reconverted into oxygen by the ozone annihilator 8 after leaving the contactor 7.

The ozone sensor 9 measures the ozone concentration in the liquid discharging from the contactor 7. The ozone-containing DI water used for the measurement is either fed back into the main flow volume or discarded by means of a waste pipe. The device 1 for generating ozonised DI water delivers, according to the selected flow volume of the DI water and the operating conditions of the system, an ozone concentration of between 50 ppm and 150 ppm.

Highly pure oxygen is supplied to the ozone generator 3, which in the case of most ozone generators operating according to the principle of silent electrical discharge, leads to a drop in the ozone concentration over its lifespan. In order to avoid this drop, CO_2 is introduced in such quantities via the choke 4 that, in the O_2/CO_2 mixture, concentrations of below 5000 ppm, preferably 300 to 1000 ppm, are achieved. Because of this supplement, the ozone generator 3 demonstrates a stable concentration behaviour over its lifespan. A larger quantity of CO_2 can also be added but is not essential. It was also able to be shown that, even with a supplement of 50,000 ppm CO_2, no disadvantageous metallic impurities were generated by the ozone generator.

The ozonised DI water is directed out of the device 1 via the pipeline 11, if necessary with the addition of further chemicals, into the tank 13 and flows through the semiconductor slices with a cleaning effect. The overflow water is collected by the collection tank 14 and carried away by the discharge pipe 15. Such a flow progression is designated as "single pass", in which the spent water with the chemicals is discarded. Such a flow progression has the disadvantage that the usage of chemicals is high. Hence, a part of the spent water can be recirculated in the circulation 17 via the filter and cleaning unit 16. Such a solution has the disadvantage that, because of possible impurities, the liquid must be filtered frequently. The better solution is chosen according to each application case.

The device 2 for cleaning the semiconductor elements according to Fig. 4 is only one embodiment.

The cleaning devices, which are known from prior art and are partly described in the introduction to the description, can of course be used.

Claims

1. Method for cleaning semiconductor elements, which are received in a tank, having ozonised, deionised (DI) ultrapure water, in the case of which method ozone is generated in an ozone generator, according to the principle of silent electrical discharge, by supplying highly pure oxygen, said ozone being supplied to a contactor which has a through-flow of DI water, the ozone being dissolved in the DI water, and in which method the ozonised DI water, possibly with the supply of further chemicals, is directed through the tank having the semiconductor elements in order to clean them and the spent DI water is removed,
characterised in that
CO_2 is added to the ozone/oxygen mixture generated by the ozone generator.

2. Method according to claim 1, characterised in that the spent DI water is filtered and re-circulated at least partially and is mixed with fresh ozonised DI water.

3. Method according to claim 1 or 2, characterised in that the cleaning is carried out in the tank, air being extensively or entirely excluded.

4. Method according to one of the claims 1 to 3, characterised in that the ozone is supplied to the contactor in counterflow to the DI water.

5. Method according to one of the claims 1 to 4, characterised in that CO_2 is directed into the highly pure oxygen flow which is supplied to the ozone generator in order to achieve a stable concentration behaviour of the ozone generator.

6. Method according to claim 5, characterised in that the CO_2 is supplied in a concentration of 300 to 5000 ppm.

7. System for cleaning semiconductor elements, having a container which receives the semiconductor elements, said container being connected to a device for generating ozonised, deionised (DI) ultrapure water via pipelines and having a discharge pipe for spent DI water, the device for generating the ozonised DI water having an ozone generator and a contactor, to which DI water is supplied and which is connected to the ozone generator, characterised in that a CO_2 source is provided which is connected to a connection pipe, which directs the ozone/oxygen mixture between the ozone generator and the contactor via a valve in order to introduce CO_2.

8. Device according to claim 7, characterised in that the ozone generator has a supply pipe for highly pure oxygen, which supply pipe is connected to the CO_2 source via a control element such as a choke.

9. Device according to claim 7 or 8, characterised in that the container is configured as an overflow tank with a collection device for the spent DI water.

10. Device according to one of the claims 7 to 9, characterised in that a part of the spent DI water is directed into the circulation via a filter and cleaning device.

11. Device according to one of the claims 7 to 10, characterised in that the container is sealed from the environment.

12. Method according to claim 1, characterised in that CO_2 is added in a concentration of up to 10%.

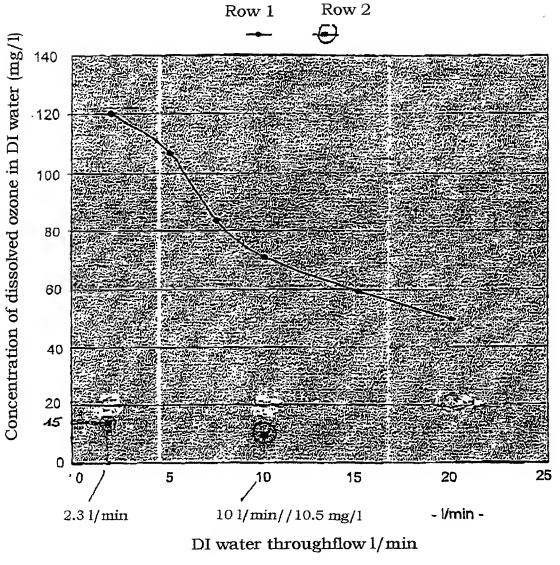
Row 1
Row 2
Concentration of dissolved ozone in DI water (mg/l)
140
120
100
80
60
40
20
45
0
0
5
10
15
20
25
2.3 l/min
10 l/min//10.5 mg/l
- l/min -
DI water throughflow l/min

Fig. 1

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09/701854

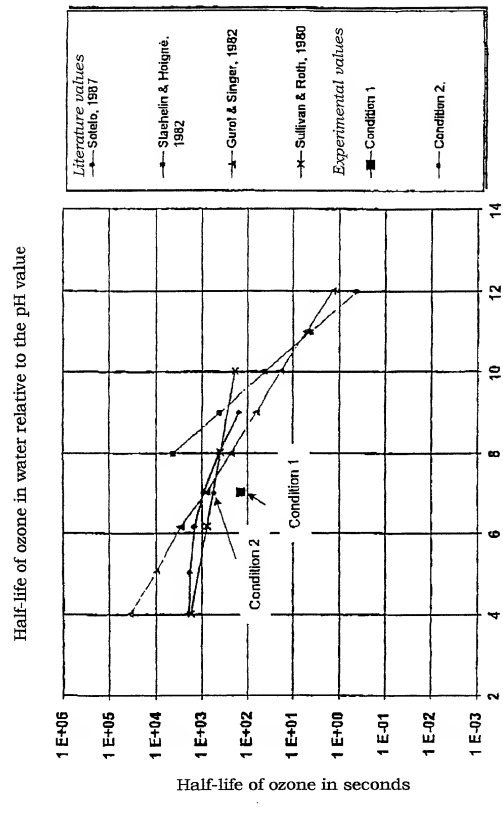


Fig. 2

FIG.3

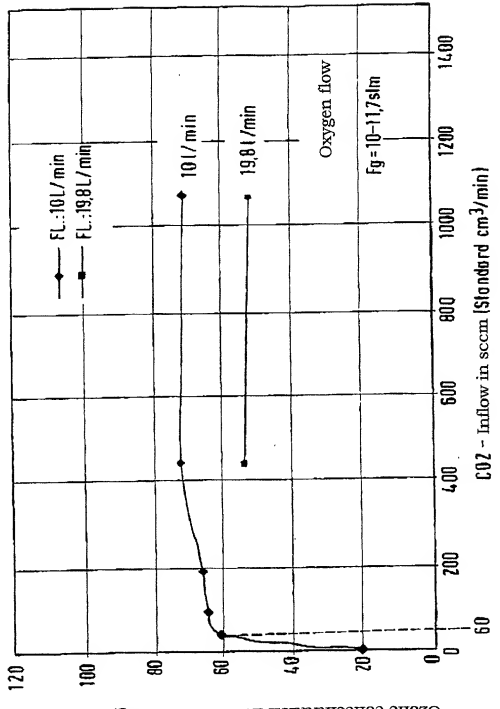
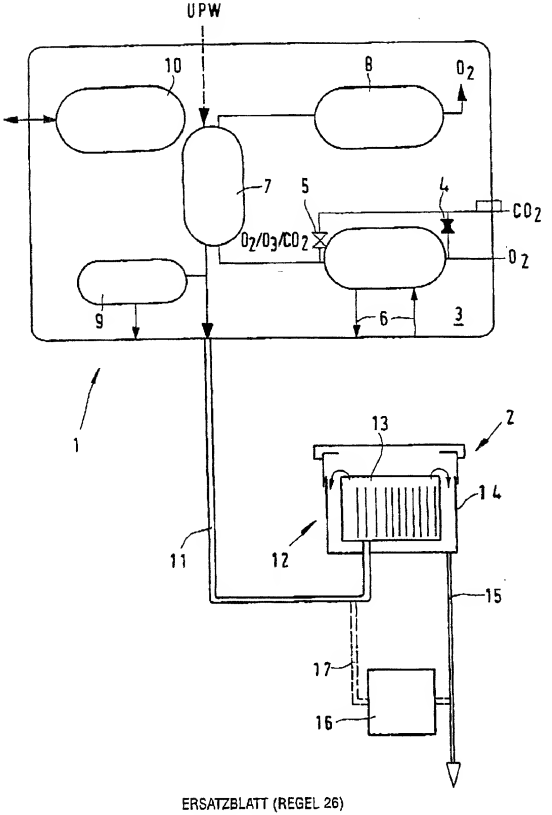


FIG.4



DECLARATION AND POWER OF ATTORNEY FOR UTILITY OR DESIGN PATENT APPLICATION		
	Attorney Docket No.	ASX-056
	First Named Inventor	Gottschalk
	COMPLETE IF KNOWN	
☐ Declaration Submitted with Initial Filing ☒ Declaration submitted after 30 months from priority date (surcharge 37 CFR 1.492(e) required)	International Application No.	PCT/EP99/03893
	International Filing Date	June 4, 1999
	Application Serial Number	09/701,854
	Filing Date	December 1, 2000
	Group Art Unit	Not Yet Assigned
	Examiner Name	Not Yet Assigned

As a below named inventor, I hereby declare that:

My residence, post office address, and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

METHOD AND SYSTEM FOR CLEANING SEMICONDUCTOR ELEMENTS

(Title of the Invention)

the specification of which

☐ is attached hereto

OR

☒ was filed on (MM/DD/YYYY) December 1, 2000 as United States Application Serial Number or PCT International Application Number 09/701,854 and was amended on (MM/DD/YYYY) December 1, 2000 *(if applicable).*

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment specifically referred to above.

I acknowledge the duty to disclose to the Patent Office all information known by me to be material to patentability as defined in 37 CFR 1.56.

I hereby claim foreign priority benefits under 35 U.S.C. 119(a)-(d) or 365(b) of any foreign application(s) for patent or inventor's certificate, or 365(a) of any PCT international application which designated at least one country other than the United States of America, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or of any PCT international application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application Number(s)	Country	Foreign Filing Date (MM/DD/YYYY)	Priority Not Claimed	Certified Copy Attached? YES	NO
19825063	DE	06/04/98	☐	☐	☒
			☐	☐	☐
			☐	☐	☐
			☐	☐	☐

☐ Additional foreign application numbers are listed on a supplemental priority data sheet attached hereto.

I hereby claim the benefit under 35 U.S.C. 119(c) of any United States provisional application(s) listed below.

Application Serial Number(s)	Filing Date (MM/DD/YYYY)

☐ Additional provisional application serial numbers are listed on a supplemental priority data sheet attached hereto.

DECLARATION – Utility or Design Patent Application

I hereby claim the benefit under 35 U.S.C. 120 of any United States application(s), or 365(c), of any PCT international application designating the United States of America, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of 35 U.S.C. 112, I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR 1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application.

U.S. Parent Application or PCT Parent Serial Number	Parent Filing Date (MM/DD/YYYY)	Parent Patent Number *(if applicable)*

☐ Additional U.S. or PCT international application numbers are listed on a supplemental priority data sheet attached hereto.

As a named inventor, I hereby appoint the following registered practitioners to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith: ☐ Customer Number → *Place Customer Number Bar Code Label Here*

OR

☒ Registered practitioner(s) name/registration number listed below

Name	Registration Number	Name	Registration Number
Steven M. Bauer	31,481	Thomas C. Meyers	36,989
John V. Bianco	36,748	Joseph B. Milstein	42,897
Isabelle A.S. Blundell	43,321	David G. Miranda	42,898
Maureen A. Bresnahan	44,559	Ronda P. Moore	44,244
Michael H. Brodowski	41,640	Indranil Mukerji	P-46,944
Jennifer A. Camacho	43,526	Edmund R. Pitcher	27,829
Joseph A. Capraro, Jr.	36,471	Michael A. Rodriguez	41,274
John J. Cotter	38,116	Jamie H. Rose	45,054
John V. Forcier	42,545	R. Stephen Rosenholm	45,283
Steven J. Frank	33,497	Christopher W. Stamos	35,370
Brian M. Gaff	44,691	Diana M. Steel	43,153
Michael J. Giannetta	42,574	Joseph P. Sullivan	45,349
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William G. Guerin	41,047	Thomas A. Turano	35,722
Jonathan A. Harris	44,744	Michael J. Twomey	38,349
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Danielle L. Herritt	43,670	Patrick R.H. Waller	41,418
Douglas J. Kline	35,574	Daniel A. Wilson	45,508
John D. Lanza	40,060	Yin P. Zhang	44,372
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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. 1001 and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Name of Sole or First Inventor:	☐ A petition has been filed for this unsigned inventor							
Given Name (first and middle [if any])				Family Name or Surname				
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☐ Additional inventors are being named on the ____ supplemental Additional Inventor(s) sheet(s) attached hereto.								
Name of Additional Joint Inventor, if any:	☐ A petition has been filed for this unsigned inventor							
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